BACTERIA TMDLS FOR THE GOOSE CREEK WATERSHED

Virginia Department of Environmental Quality

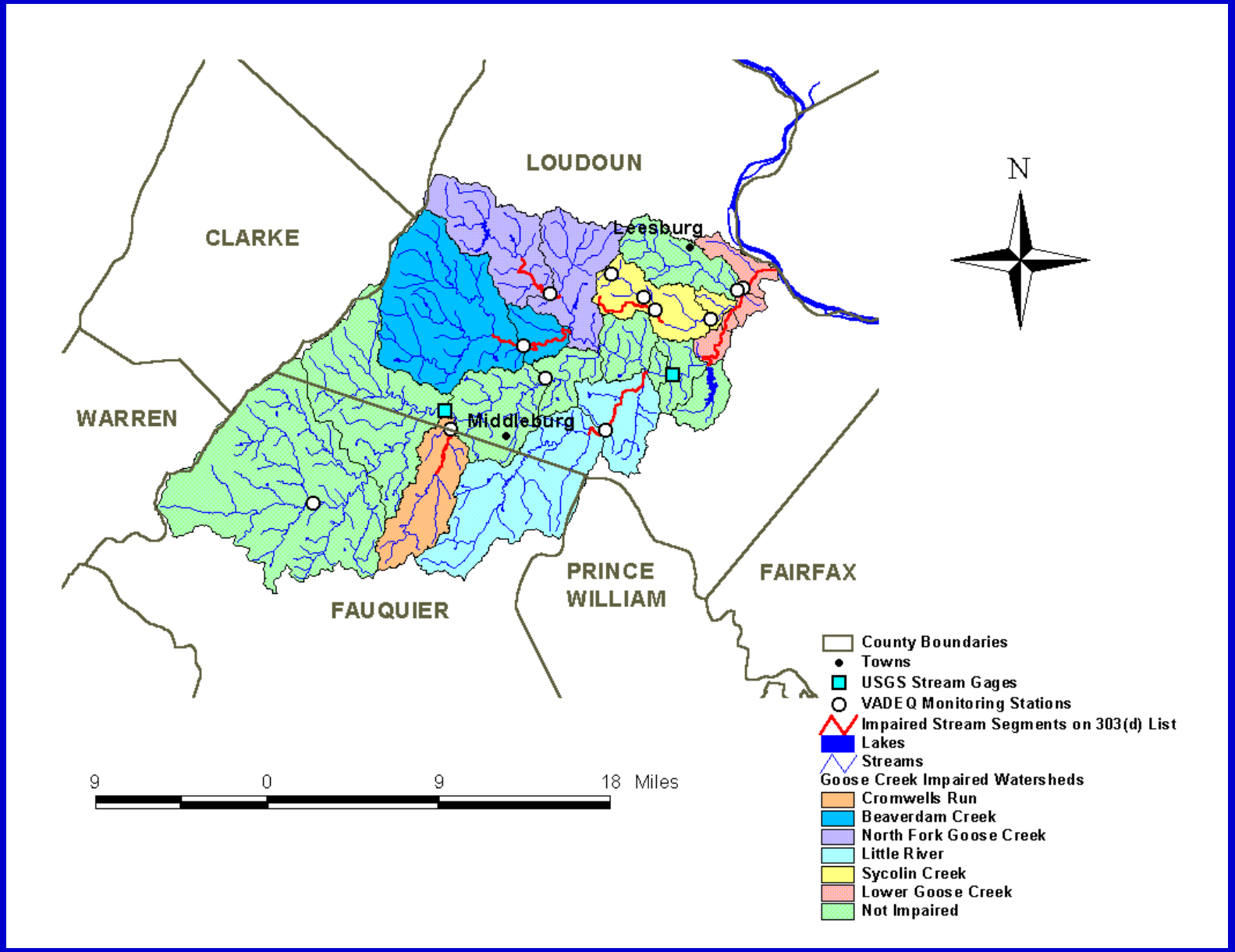
Virginia Department of Conservation and Recreation

Interstate Commission on the Potomac River Basin

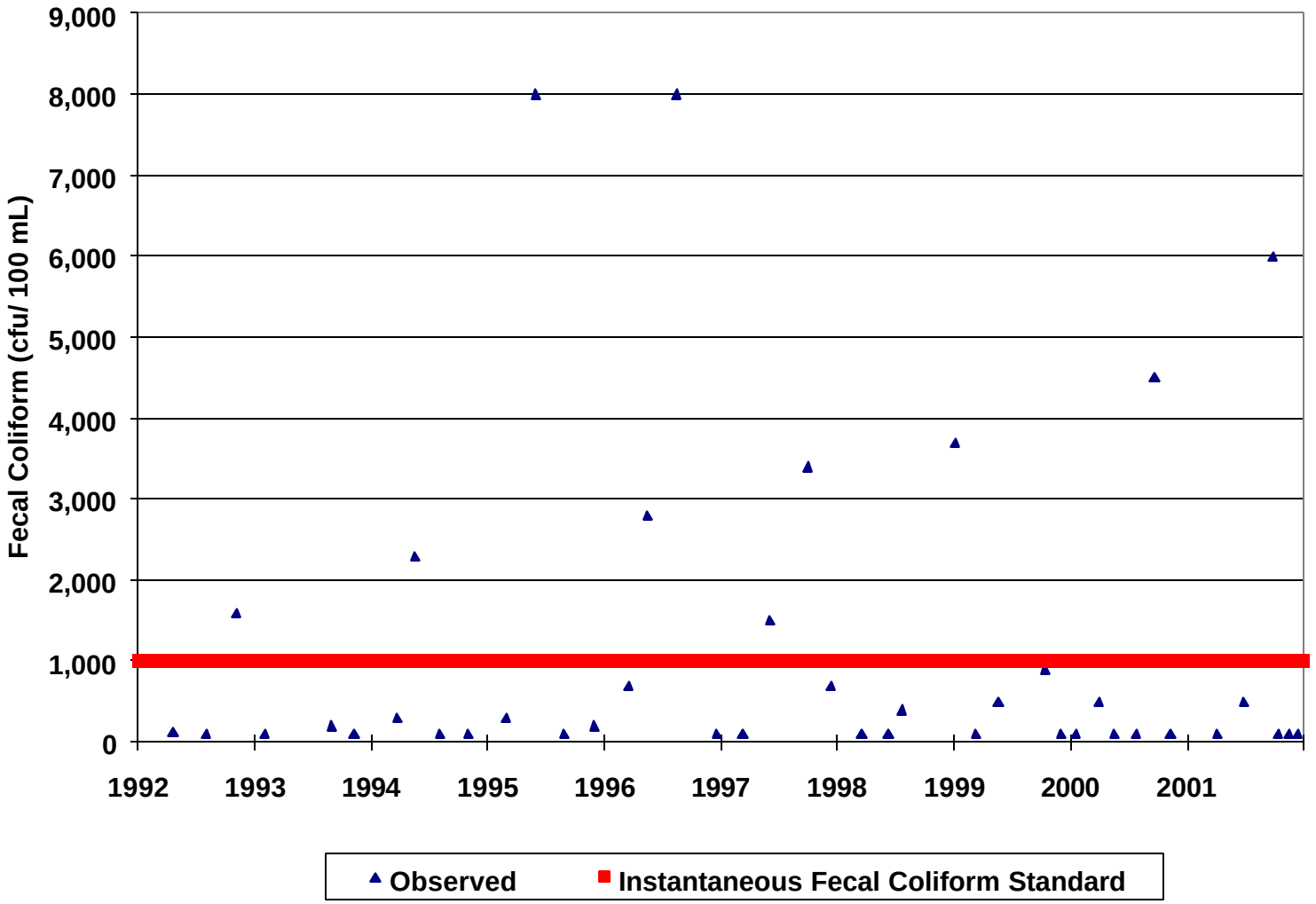
WATERBODIES IMPAIRED BY FECAL COLIFORM BACTERIA IN THE GOOSE CREEK WATERSHED

- Cromwells Run
- Little River
- Beaverdam Creek
- North Fork Goose Creek
- Sycolin Creek
- South Fork Sycolin Creek
- Lower Mainstem of Goose Creek

IMPAIRED WATERBODIES IN THE GOOSE CREEK WATERSHED



MONITORING DATA FOR CROMWELLS RUN



ESSENTIAL STEPS IN TMDL PROCESS

- **SOURCE ASSESSMENT:**
  Identify and quantify all existing sources of pollutant.

2. COMPUTER MODELING:

Develop model to explain and predict the response of the waterbody to different levels of pollutant loads.

3. LOAD ALLOCATION:

Determine level of pollutant load that allows the waterbody to meet water quality standards and allocate that load to sources.

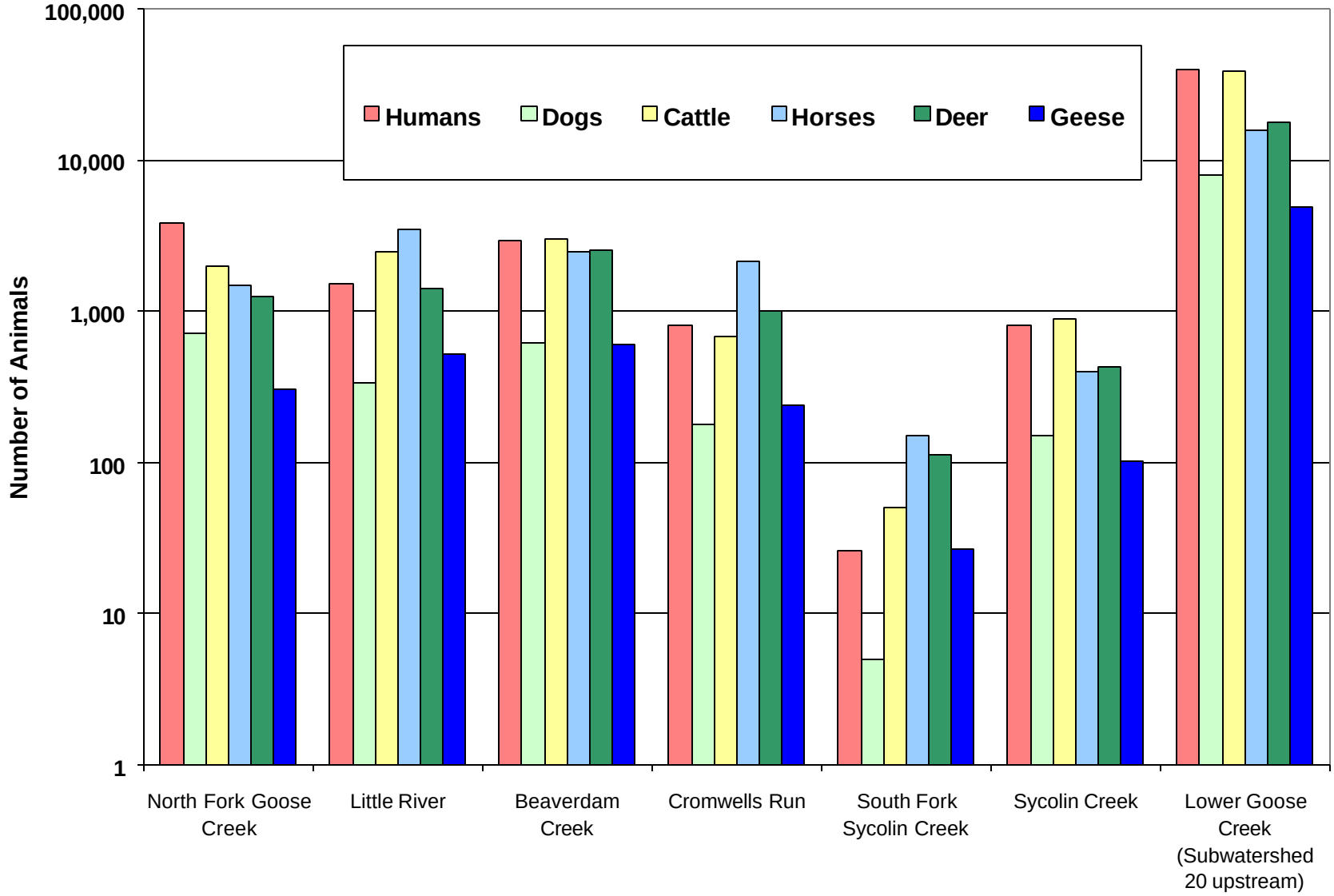
SOURCE ASSESSMENT

- **Determine human and animal populations by subwatershed**
- **Estimate bacteria produced per animal per day**
- **Calculate how much of the bacteria is deposited directly in streams and how much is deposited on the land surface**

POTENTIAL SOURCES OF FECAL COLIFORM BACTERIA

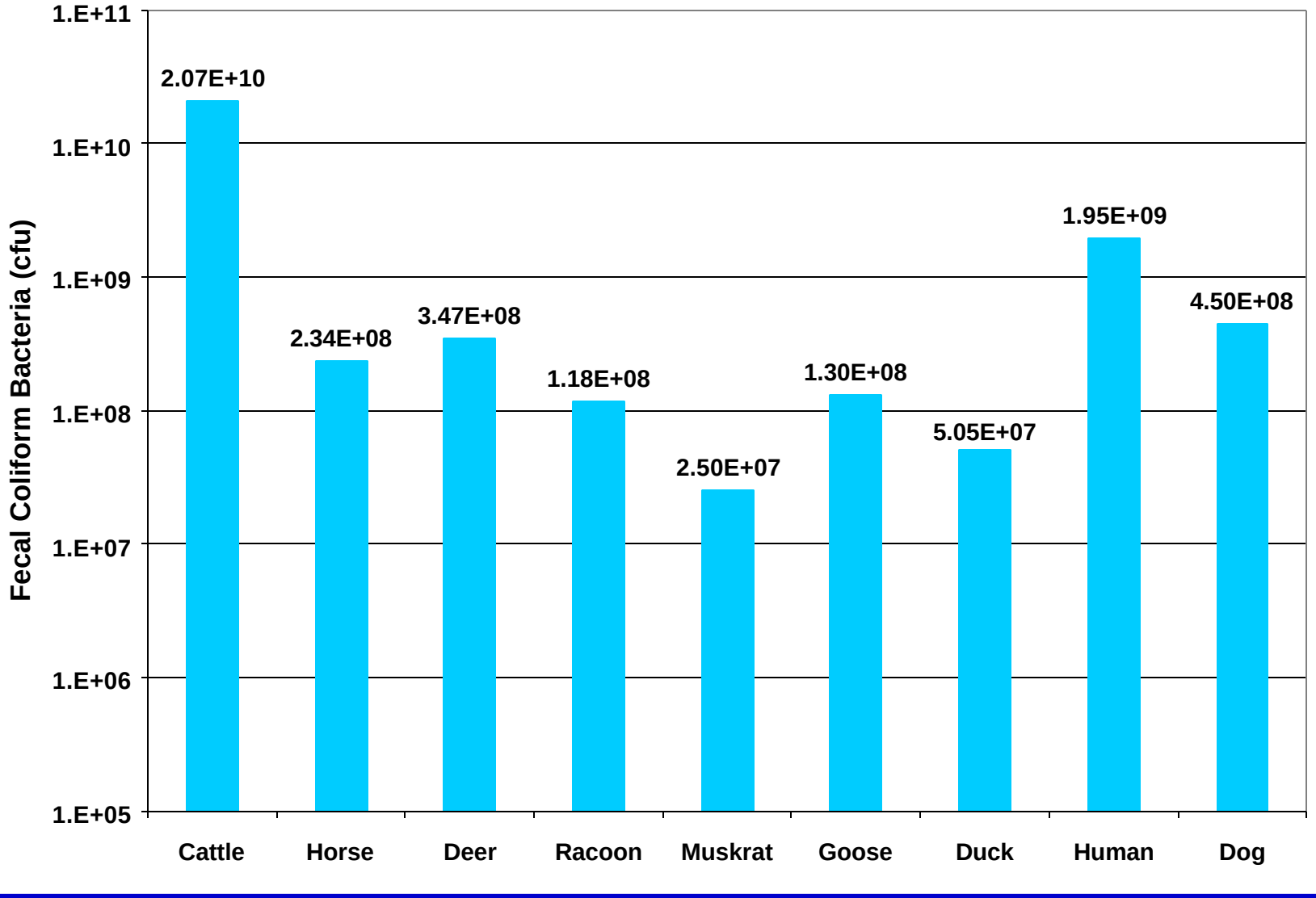
- Failing Septic Systems
- Wastewater Treatment Plants
- Pet Waste
- Wildlife
- Direct Deposit of Livestock Waste in Streams
- Runoff from Pasture and Feedlots
- Runoff from Manure Applied to Crop Land
- Biosolid Applications

HUMAN AND ANIMAL POPULATIONS IN GOOSE CREEK WATERSHED

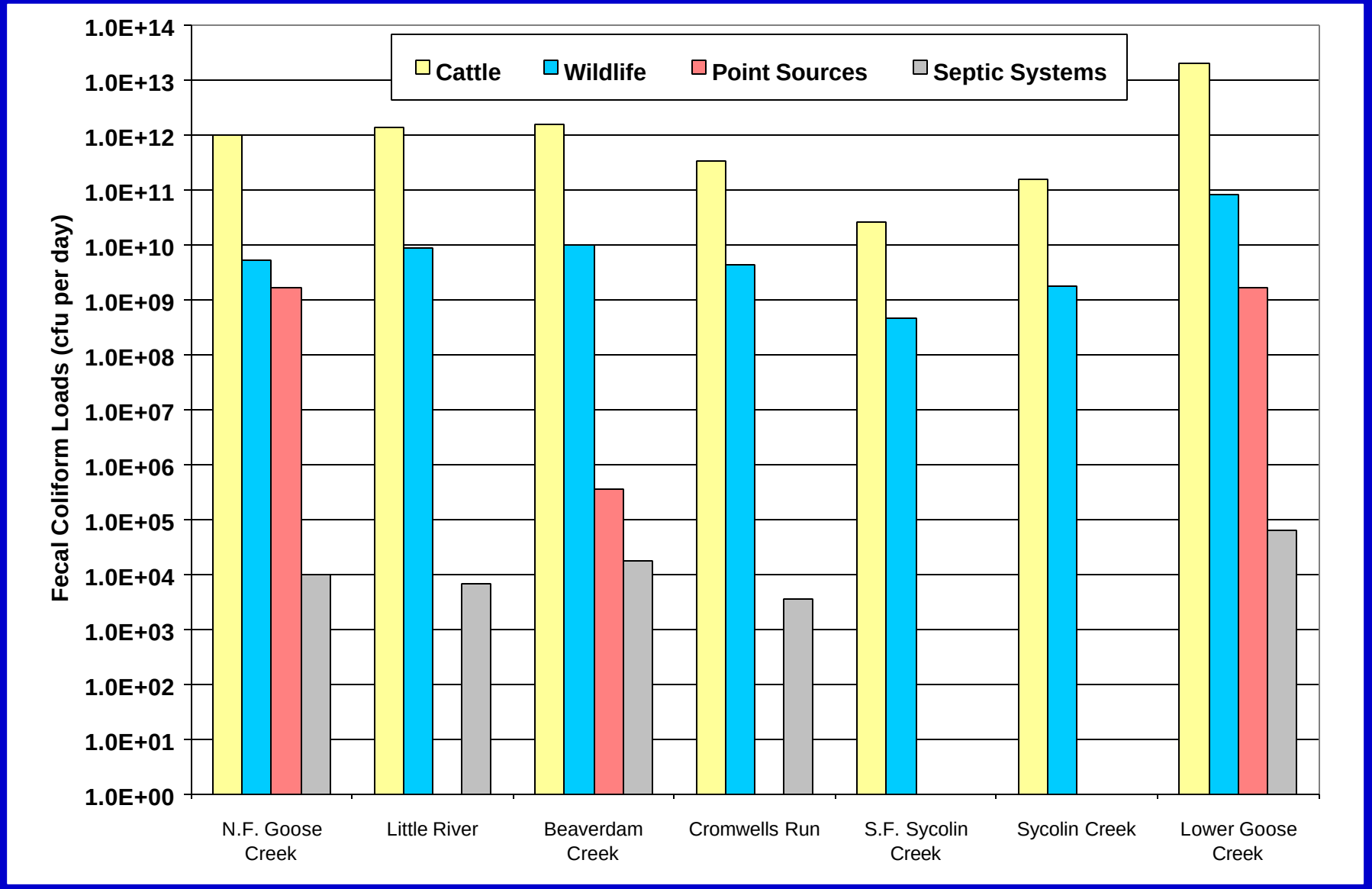


BACTERIA GENERATION BY ANIMAL TYPE

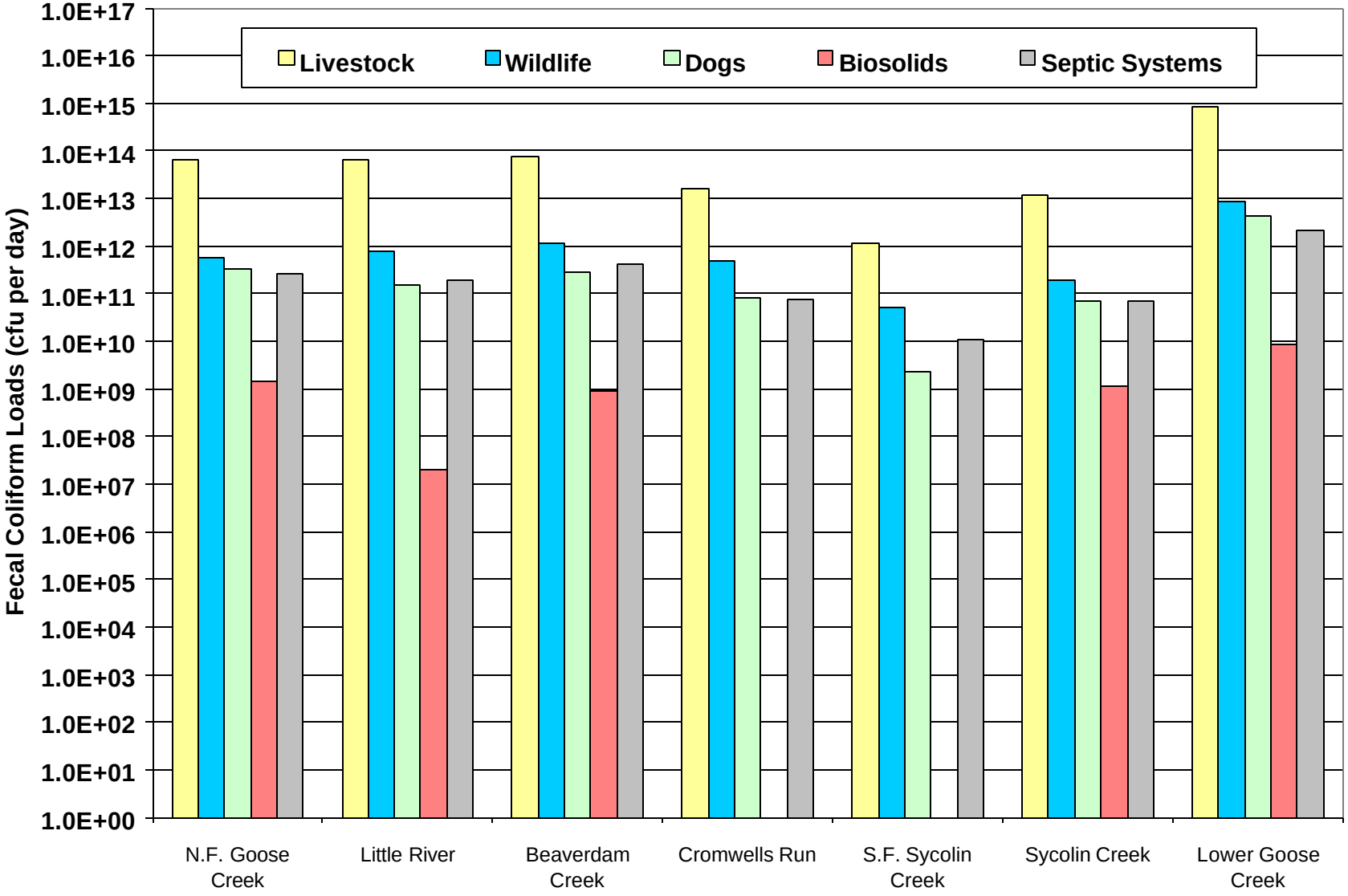
(cfu/animal/day)



AVERAGE DAILY FECAL COLIFORM LOAD DIRECTLY DEPOSITED IN STREAMS



AVERAGE DAILY FECAL COLIFORM LOAD DEPOSITED ON LAND



COMPUTER SIMULATION MODELS

- **CALCULATE nonpoint source loads in runoff**
- **Provide the LINK between pollutant loads and water quality conditions**
- **EXPLAIN connection between current loads and observed conditions**
- **PREDICT the response of water quality conditions to changes in pollutant loads**

TRENDS IN MONITORING DATA

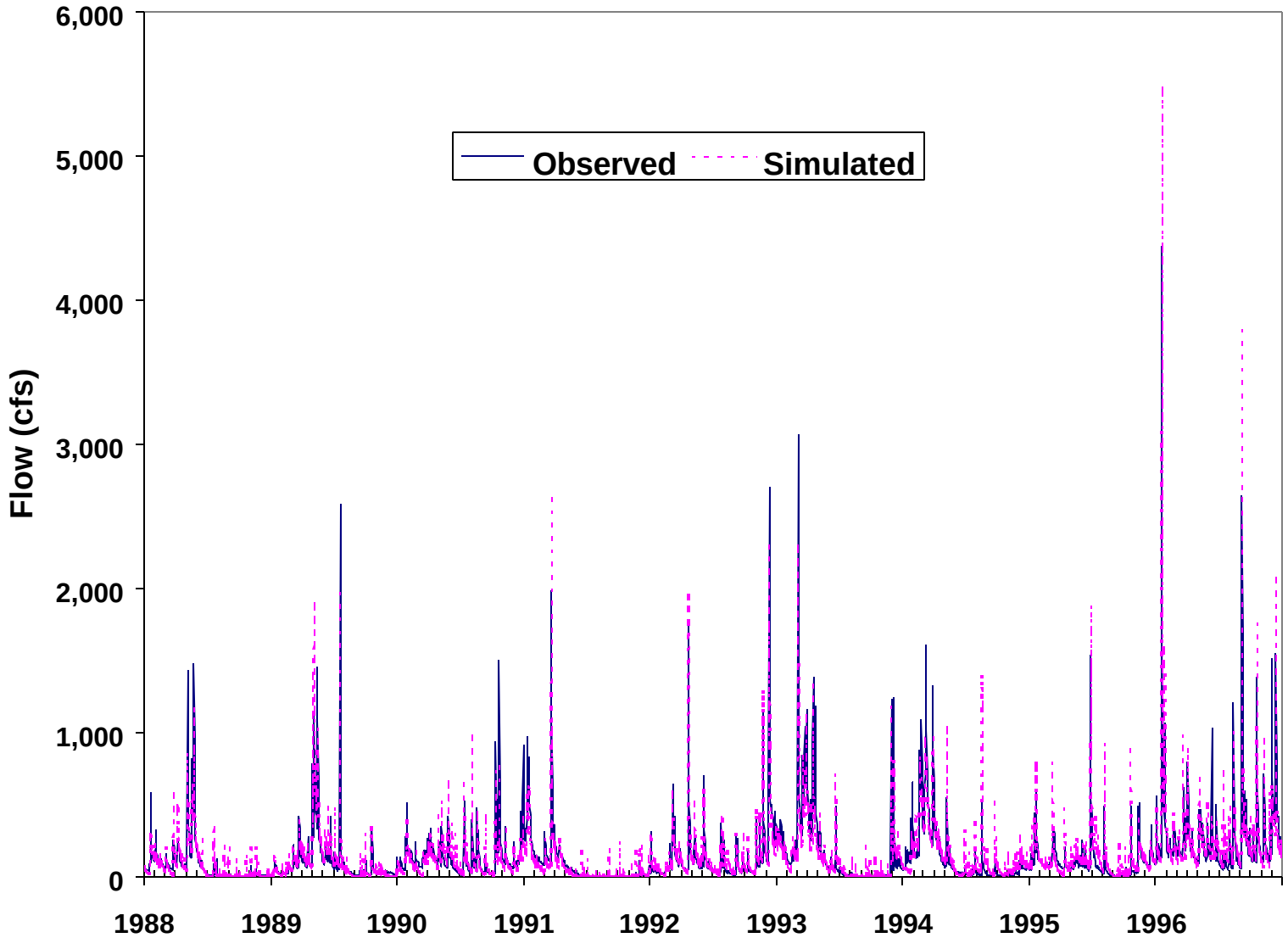
- **High observed fecal coliform concentrations tend to occur under high flow conditions**

- **Fecal coliform concentrations tend to be higher in the summer than the winter**

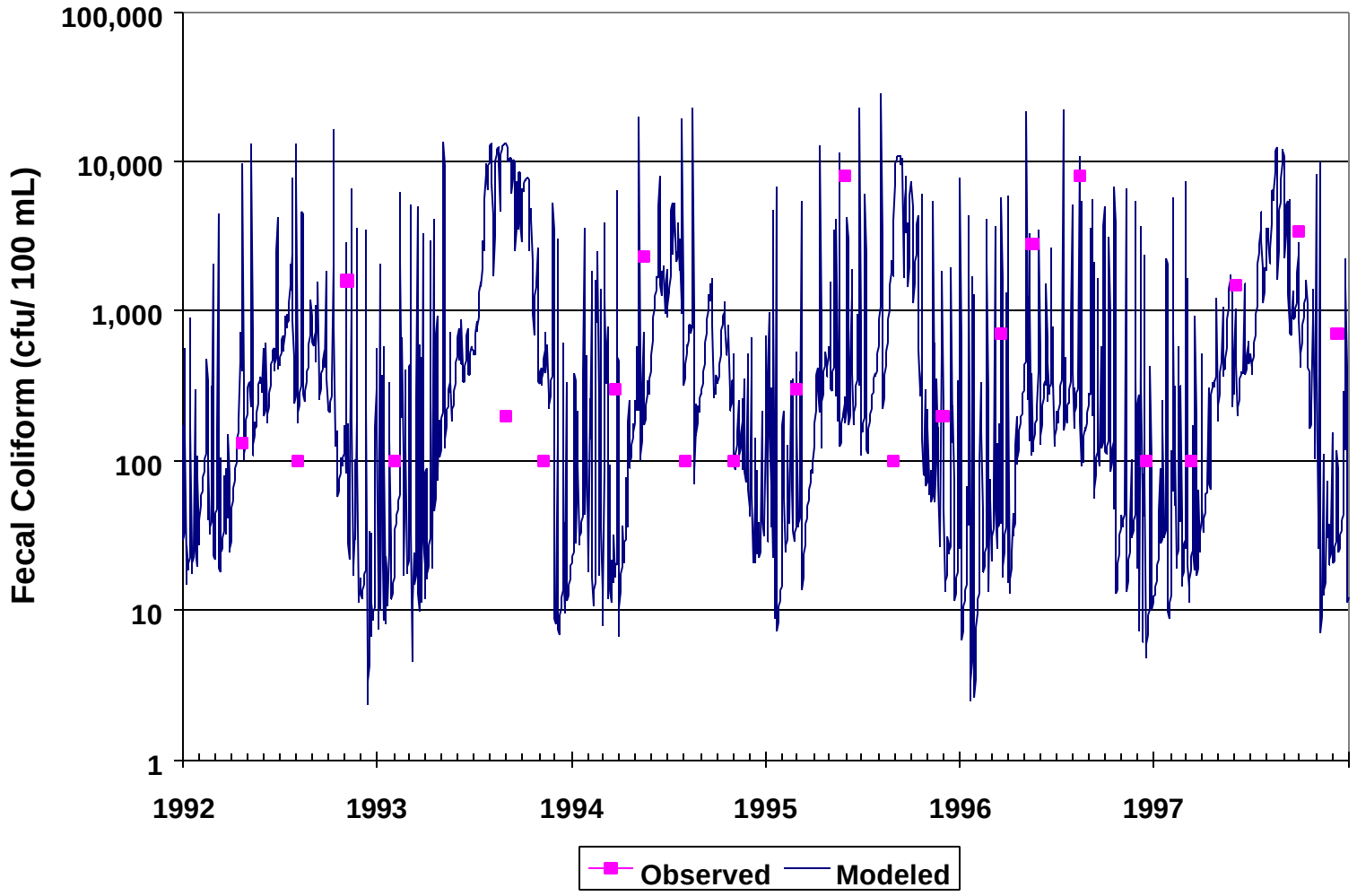
MODEL CALIBRATION

- **Match simulated frequency of violations of the Instantaneous Standard (1000 cfu / 100mL) to observed frequency**
- **Match range of observed values: Concentrations higher following runoff events**
- **Match seasonal trends: Concentrations higher in summer than winter**

HYDROLOGY CALIBRATION AT LEESBURG: 1988 to 1991



CROMWELLS RUN
FECAL COLIFORM CALIBRATION



SIMULATED VERSUS OBSERVED EXCEEDANCE RATES (1992-2001*)

Watershed	Rate of Exceedance	
	Observed	Simulated
Lower Goose Creek	0.10	0.11
Tuscarora Creek	0.11	0.11
Sycolin Creek	0.20	0.20
North Fork Goose Creek	0.33	0.37
Little River	0.27	0.30
Beaverdam Creek	0.27	0.29
Middle Goose Creek	0.09	0.09
Cromwells Run	0.24	0.22
Sycolin Creek	0.40	0.35
South Fork Sycolin Creek	0.27	0.26
Sycolin Creek	0.17	0.32

*Because of differences in assessment period, violation rates may differ from 305(b) assessments.

PERCENT CONTRIBUTION OF SOURCE LOADS

Subwatershed	Directly Deposited Loads		Loads in Runoff			
	Wildlife	Cattle	Forest	Crop	Pasture	Developed
N.F. Goose Creek	0.17%	42.4%	0.0%	0.0%	56.9%	0.5%
Little River	0.20%	27.6%	0.5%	0.0%	71.2%	0.4%
Beaverdam Creek	0.16%	35.5%	0.2%	0.0%	63.7%	0.4%
Cromwells Run	0.31%	25.1%	0.9%	0.0%	73.0%	0.6%
S.F. Sycolin	0.34%	18.9%	1.0%	0.0%	78.8%	0.9%
Sycolin	0.17%	42.6%	0.4%	0.1%	56.2%	0.5%
Lower Goose Creek	0.15%	40.1%	0.4%	0.3%	58.7%	0.4%

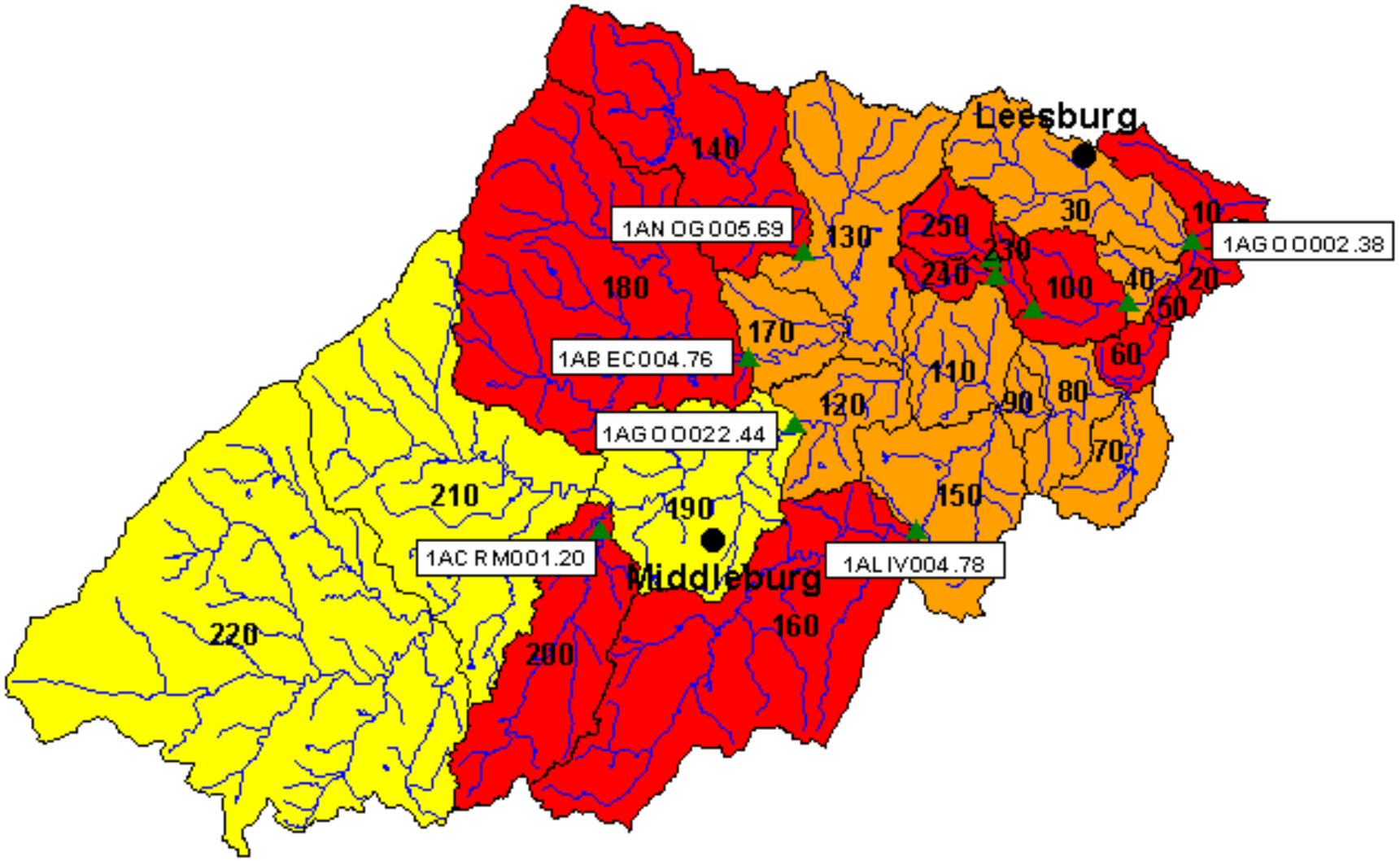
LOAD ALLOCATION

- **TMDL allocation must meet new fecal coliform bacteria and *E. coli* bacteria standards**
- ***E. coli* bacteria concentrations predicted on basis of relationship determined by DEQ from VA monitoring data**

NEW FECAL COLIFORM AND E. COLI BACTERIA STANDARDS

- **The geometric mean of fecal coliform samples taken in a calendar month must be less than 200 cfu/ 100 mL**
- **No more than 10% of the fecal coliform samples taken in a calendar month can be larger than 400 cfu /100 mL.**
- **The geometric mean of *E. Coli* samples taken in a calendar month must be less than 126 cfu/ 100 mL**
- **The concentration of any single sample of E. Coli bacteria cannot exceed 235 cfu/ 100 mL**

GOOSE CREEK SEGMENTATION



ALLOCATION SCENARIO 1

- No reductions upstream of VADEQ Station 1AGOO022.44
- For the remainder of the watershed (including Cromwells Run):
  - 100% reduction in direct deposition loads from cattle
  - 100% reduction of loads from failing septic systems
  - 100% reduction in runoff loads from pasture, cropland, and developed land

Watershed	Fecal Coliform Standard Violations		E. Coli Standard Violations	
	Geometric Mean	Monthly	Geometric Mean	Instantaneous
Lower Goose Creek	19	18	21	203
N.F. Goose Creek	0	0	0	0
Little River	0	0	0	0
Beaverdam Creek	0	0	0	0
Cromwells Run	0	0	0	0
Sycolin Creek	0	0	0	0
S.F. Sycolin Creek	0	0	0	0
N.F. Sycolin Creek	0	0	0	0

ALLOCATION SCENARIO 3

- 100% reduction in direct deposition loads from cattle
- 100% reduction in loads from failing septic systems

Watershed	Fecal Coliform Standard Violations		E. Coli Standard Violations	
	Geometric Mean	Monthly	Geometric Mean	Instantaneous
Lower Goose Creek	0	53	0	423
N.F. Goose Creek	0	40	0	327
Little River	1	59	1	478
Beaverdam Creek	0	45	0	382
Cromwells Run	0	35	0	290
Sycolin Creek	0	36	0	330
S.F. Sycolin Creek	0	45	0	399
N.F. Sycolin Creek	0	36	0	330

ALLOCATION SCENARIO 8

- 100% reduction in direct deposition loads from cattle
- 100% reduction in loads from failing septic systems
- 99% reduction in runoff loads from pasture in Cromwells Run and Little River
- 98% reduction in runoff loads from pasture elsewhere

Watershed	Fecal Coliform Standard Violations		E. Coli Standard Violations	
	Geometric Mean	Monthly	Geometric Mean	Instantaneous
Lower Goose Creek	0	0	0	0
N.F. Goose Creek	0	0	0	0
Little River	0	0	0	0
Beaverdam Creek	0	0	0	0
Cromwells Run	0	0	0	0
Sycolin Creek	0	0	0	0
S.F. Sycolin Creek	0	0	0	0
N.F. Sycolin Creek	0	0	0	0

SUMMARY OF LOAD ALLOCATION RESULTS

- **SCENARIO 1:**
  - **LOAD REDUCTIONS MUST BE MADE UPSTREAM OF 1AGOO022.44 TO MEET WATER QUALITY STANDARDS IN LOWER GOOSE CREEK**
- **SCENARIO 3:**
  - **REDUCTION IN LOADS DIRECTLY DEPOSITED INTO STREAMS BY CATTLE AND WILDLIFE ARE INSUFFICIENT TO MEET WATER QUALITY STANDARDS**
- **SCENARIO 8:**
  - **A 100% REDUCTION IN LOAD FROM CATTLE IN STREAM AND A GREATER THAN 95% REDUCTION IN LOADS IN PASTURE RUNOFF ARE NECESSARY AND SUFFICIENT TO MEET WATER QUALITY STANDARDS EVERYWHERE IN THE GOOSE CREEK WATERSHED**

IMPLEMENTATION

- **The TMDL will be implemented in stages.**
- **The public will have the opportunity to participate in the development of an implementation plan.**

PROPOSED
PHASE I IMPLEMENTATION GOALS

- **100% reduction in bacteria deposited directly in streams by cattle**
- **100% reduction in bacteria from failing septic systems**
- **50% reduction in bacteria loads from pasture runoff**

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